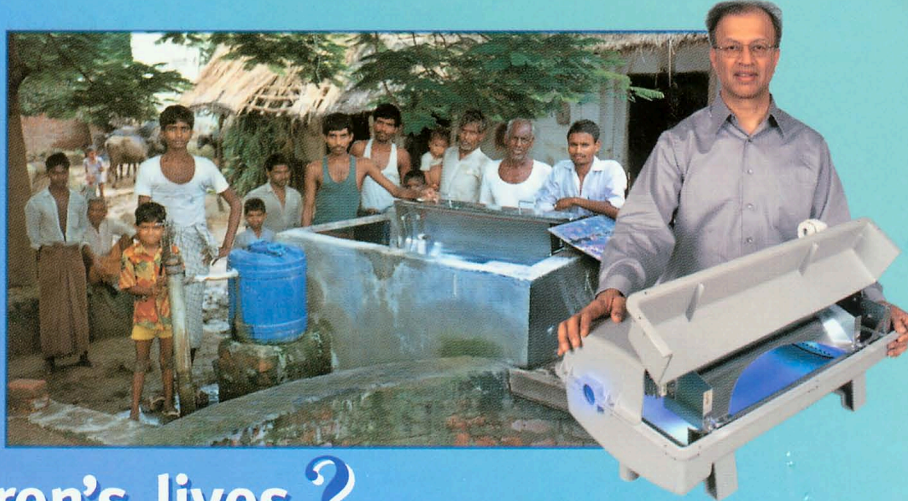


# did you ever wonder..?

## ...how a portable water purifier saves children's lives?



In a world where a billion people live without access to safe water, more than six young children die every minute because of contaminated drinking water.

Now a water purifier invented by Berkeley Lab physicist Ashok Gadgil is bringing safe water to developing nations and to victims of natural disasters. UV Waterworks is portable, rugged, and inexpensive; it disinfects enough water for a small village using no more power than a 60-watt bulb—power that, in a pinch, can be supplied by a bicycle generator.

Growing up in Bombay, India, Gadgil knew he wanted to be a scientist by the age of nine. No science kits were available, so he had to be creative. “My chemistry experiments stunk up the house.”

He read voraciously in his father's home library—“*Life*, *Look*, and *Scientific American* gave us a window on the outside world,” he says—and by the sixth grade had read all his future high school textbooks.

Although studying medicine or engineering was more respectable than pure science in India at the time, Gadgil's father believed that “if a child is passionate, let him bloom in that direction.” Gadgil earned physics degrees from the University of Bombay and the Indian Institute of Technology at Kanpur; in the early 1970s he went to UC Berkeley, seeking practical experience in physics research.

Gadgil believes that in “a world of contending beliefs and fickle artistic fashion, science reaches for bedrock truth.” And for him, truth has always had a human dimension.

Shortly after he arrived in the US, an energy crisis struck. He knew that “if the United States—where five percent of the world's population consumed almost 40 percent of the energy—was in trouble, India would be flattened.”

From then on he concentrated on environmental physics.

With a Ph.D. from UC Berkeley in 1979, he joined

Berkeley Lab in 1980. Much of his work has been with solar energy, biodiversity, conservation, and clean air.

**“The nice thing about being at Berkeley Lab,” Gadgil says, “is that even when conventional wisdom says it can't be done, the tradition is to go out and do it anyway.”**

Today he leads a group in the Lab's Environmental Energy Technologies Division studying how to control airborne pollutants inside buildings. Gadgil holds numerous

patents and has won numerous awards; as one of the scientists profiled in the documentary feature film *Me and Isaac Newton*, he is even a “movie star.”

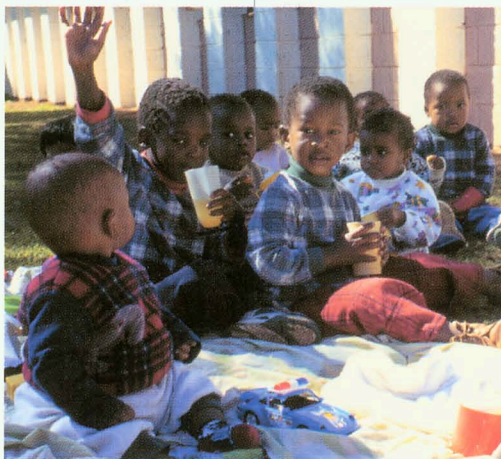
The movie *Me and Isaac Newton* is described at

<http://www.clearblueskyfilms.com/documentaries/main/>

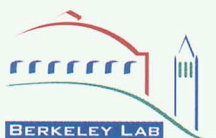


For more about the world of great science, visit Berkeley Lab's “Did You Ever Wonder” Website at

<http://www.lbl.gov/wonder/>



Infants at the Lily of the Valley AIDS hospice for orphans near Durban, which in August, 1997, became the first site for the field test of UV Waterworks in South Africa.



Visit Berkeley Lab at [www.lbl.gov](http://www.lbl.gov)



# UV Waterworks

**W**hile Ashok Gadgil was growing up in India in the 1950s, water-borne disease killed five of his infant cousins. In 1993 a cholera epidemic struck India, and Gadgil, by then at Berkeley Lab, made up his mind to develop an effective water purifier.

Boiling water takes fuel, hard to come by in rural India. Chlorination works well in centralized water systems, but the practical solution for

In Bhupalpur, India, the villager standing at right uses a hand pump to supply water to a UV Waterworks disinfection unit inside the cement tank.



Indian villages was ultraviolet light, which does not kill organisms outright but disrupts their DNA so they quickly die out without reproducing.

Most UV systems need pressurized water from heavy pumps that draw a lot of power. Gadgil knew that to serve

## Passing the (solar) torch

Environmental problems can't be solved without basic science and better ways to apply it—which means the world needs inventors.

A prolific inventor himself, Ashok Gadgil also volunteers as an Invention Mentor to winners of the Lemelson-MIT High School Invention Apprenticeship (for more about the program, see <http://web.mit.edu/invent>).

A recent winner is Jordan Sand, an 18-year-old high school student from North Dakota who chose to spend several weeks with Gadgil's group at Berkeley Lab so he could see, first-hand, ideas in the process of being developed and winnowed out as practical inventions. Sand's wish to study with Gadgil was an obvious choice: when he was still in the 7th grade, Sand invented a solar-powered water purifier.

Sand, who lives on a farm, has focused his ingenuity on ways to benefit the environment while helping the economy of the local farming community. His winning invention was a new use for agricultural waste from local crops: he developed a method to manufacture paper from wheat, corn, and flax straw, as well as cattails, which could provide additional income to farmers.

For more about Jordan Sand, see <http://web.mit.edu/invent/www/01apprentice.html>

poor rural populations, a UV water purifier would have to treat water that was hand pumped or even hand poured.

Gadgil began working after hours with scrounged parts and volunteer help. When the Department of Energy, the US Agency for International Development, and private sources provided grants, he was able to test a prototype UV water purifier in a few Indian villages—he knew it was too heavy and too expensive, but he could fix that later. The biggest surprise was that it was too efficient! At eight gallons a minute, the villagers couldn't pour water into it fast enough, and it produced more clean water than they could use.

**After redesign, the new UV Waterworks weighs only 15 pounds, disables all the pathogenic bacteria and viruses in four gallons of water each minute, uses less energy than a desk lamp and, when a wall socket isn't available, runs on power from a car battery, bicycle generator, windmill, or solar cell.**



For more about worldwide use of UV Waterworks, including technical details, see <http://www.waterhealth.com>

## Tracking polluted air

Water and air are both fluids; understanding how they flow is one of the keys to better human health.

At Berkeley Lab, scientists model large indoor spaces like auditoriums in test chambers such as the "fish tank," which uses water to stand in for air; flowing dye is easy to see. In a full-sized test facility, pollutants are picked out by laser beams, and airflow patterns are constructed in a way similar to the CAT scans used in medicine. Computer programs can also simulate the flow of air and various pollutants, whether mixed together or not, through different interior zones.

Understanding how air and pollutants move through a building has led to healthier ventilation systems. It also gives firefighters and other emergency response teams the vital information they need to stop the spread of dangerous vapors through a building, whether spilled accidentally or released deliberately. And it saves energy too!

For more about Berkeley Lab's Airflow and Pollutant Transport Group, visit <http://eetd.lbl.gov/ied/APT/APT.html>. For more about the indoor environment, see <http://eetd.lbl.gov/IED/IED.html>